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Maternal and fetal outcomes of HIV-infected and non-infected pregnant women admitted to two intensive care units in Pietermaritzburg, South Africa

N C Ngene,[1] MB BS, Dip HIV Man, MMed (FamMed), FCOG (SA); **J Moodley**,[2] MB ChB, FRCOG, FCOG (SA), MD; **P Songca**,[3] MD, MMed (O&G), FCOG (SA); **R von Rahden**,[4] BSc (LabMed), MB BCh, Adv Dipl Appl Physiol, FCA (SA), Cert Crit Care (SA); **F Paruk**,[5] MB ChB, FCOG (SA), Cert Crit Care (SA), MD; **C O Onyia**,[6] MB BS; **S van der Linde**,[7] MSc (Statistics)

[1] *Department of Obstetrics and Gynaecology, Grey's Hospital, Pietermaritzburg; University of KwaZulu-Natal, South Africa*
[2] *Department of Obstetrics and Gynaecology and Women's Health and HIV Research Group, University of KwaZulu-Natal, South Africa*
[3] *Department of Obstetrics and Gynaecology, Edendale Hospital, Pietermaritzburg, South Africa*
[4] *Anaesthetist, Grey's Hospital, Pietermaritzburg, South Africa*
[5] *Cardiothoracic Intensive Care Unit, Department of Anaesthesiology, University of the Witwatersrand, Johannesburg, South Africa*
[6] *General practitioner, Pietermaritzburg, South Africa*
[7] *School of Public Health and Nursing, University of KwaZulu-Natal, South Africa*

Corresponding author: *N C Ngene (ngenenc@gmail.com)*

Background. Outcomes of HIV-positive pregnant patients admitted to intensive care units (ICUs) are controversial.
Objective. To determine maternal and fetal outcomes of HIV-positive patients admitted to ICUs.
Methods. Pregnant patients admitted to ICUs were enrolled in the study. On admission, they were classified as having low (<50%) or high (≥50%) risk of death by GRAMPT stratification score. The primary maternal outcome was death or hypoxic-ischaemic brain injury (HIBI), while fetal outcomes recorded were Apgar score, birth weight, and delivery of the fetus to facilitate maternal care.
Results. There were 84 admissions to the ICUs: 66 (78.6%) were post-partum and 18 (21.4%) antepartum. The HIV sero-status was as follows: 11 (13.1%) HIV status unknown; 42 (50%) HIV-negative and 31 (36.9%) HIV-positive. The most common pre-ICU admission diagnoses were pneumonia (19.4%) in HIV-positive patients and eclampsia (31%) in HIV-negative patients. Maternal outcomes showed a worsening trend among the HIV-positive women when compared with those who were HIV-negative (high GRAMPT, 1.91 relative risk of death/HIBI in HIV-positive; 95% CI 0.57 - 6.44). Forty-two patients gave birth within 24 hours prior to ICU admission; 3 gave birth while in ICU and none gave birth within 24 hours following ICU discharge. Outcomes of the 45 infants born to HIV-positive women were worse than for those born to HIV-negative patients (except for Apgar scores 1 - 6). Performance of the GRAMPT model for prediction of maternal mortality/HIBI was best in hypertensive patients (ROC: AUC 0.72; 95% CI 0.48 - 0.96).
Conclusion. With the exception of Apgar scores 1 - 6, all outcomes showed worsening trends among infants born to HIV-positive mothers. Large multicentre studies are needed to confirm our findings.

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Advances in obstetric care, alongside efforts to implement best practices, have not diminished the need for critical care facilities. Obstetric patients constitute 1.8% of intensive care unit (ICU) admissions in a well-resourced country like the UK,[1] but this rises to 23.7% in under-resourced countries.[2]

Globally, the ICU constitutes an expensive service and demand typically exceeds the supply of available beds; therefore, triage is essential, in order to favour those who have better chances of survival. There is a perception that HIV-positive patients tend to have poor outcomes, particularly if they are antiretroviral therapy (ART) naive; this may bias clinicians against admitting such patients to limited ICU resources. Although Bhagwanjee *et al.*[3] had previously shown that HIV infection in adults did not predict ICU mortality, their study was undertaken at a very early stage of the HIV epidemic in South Africa (SA), when there were few AIDS cases and ART was not available.

Predicting ICU survival among critically ill patients, particularly pregnant women, is very challenging. Available ICU scoring systems which predict ICU survival and mortality have shown inconsistent results in pregnant patients.[4] This may be because conventional scoring systems do not factor in the physiological changes of pregnancy. To address these issues, Paruk developed and validated the GRAMPT scoring system for pregnant and post partum patients in 2007 (see a detailed description of the GRAMPT system below). They found that, when used within the first 24 hours of ICU admission, their model was superior to the Acute Physiology and Chronic Health Evaluation (APACHE) II system in predicting mortality. Moreover, the mortality predicted by the GRAMPT model correlated with the magnitude of the inflammatory response, as well as the number and duration of organ failures.[5]

The HIV pandemic has become increasingly feminised, with young women comprising 58% of people living with HIV in Sub-Saharan Africa.[6] In SA in 2010, HIV prevalence among antenatal clinic attendees was 30.2%, with the highest prevalence (42.3%) in the Pietermaritzburg area.[7] These high rates have made HIV/AIDS the most common cause of maternal deaths in SA. For socio-economic and administrative reasons, not all HIV-positive pregnant patients

receive ART.[8] This can potentially lead to infectious complications which may increase the likelihood of HIV-positive pregnant women requiring ICU admission.

Given the high incidence of HIV infection and the scarcity of ICU facilities in our environment, we performed a prospective study to determine the maternal and fetal outcomes of HIV-positive and -negative patients who were either pregnant or up to 42 days post partum, who were admitted to ICUs. As well as improving the scarcity of published studies on the fetal outcomes of pregnant patients admitted to ICU, the study also assessed whether the GRAMPT score obtained at the time of ICU admission might assist with triage.

Methods

The study was conducted in the adult ICUs of a regional and tertiary hospital complex in Pietermaritzburg, SA. In the regional hospital, the ICU was a 6-bed mixed medical-surgical ICU, while the ICUs in the tertiary hospital consisted of a 5-bed mixed medical-surgical ICU and a 4-bed coronary care unit. Patients were admitted to these ICUs based on the clinical judgment of a consulting intensivist. Whether or not a patient was admitted was determined by their overall clinical condition, not their HIV sero-status. ICUs in both hospitals were managed by the same team of medical health professionals.

Data were obtained prospectively from the hospital charts of all antenatal and postpartum women admitted over a 10-month period (1 July 2010 - 30 April 2011). This duration was purely determined by convenience, due to time constraints. Each patient was classified as having a low (<50%) or high (≥50%) risk of death according to the GRAMPT stratification model. In each GRAMPT sub-category, patients were sub-divided according to their HIV status (obtained from hospital records) into HIV-positive, HIV-negative or HIV-uknown. Each patient was followed up from the time of ICU admission until either the seventh day post-ICU discharge or until hospital discharge (whichever came first). Because many patients came from rural areas with poor telecommunication and transport services, it was not possible to follow patients up to the extent required to determine 28-day all-cause mortality.

The primary maternal outcome considered was hypoxic-ischaemic brain injury (HIBI) or death, either in the ICUs or in the hospital wards in the week after ICU discharge. Patients who had cerebral death, i.e. permanent vegetative state, following cardiopulmonary resuscitation were regarded as having HIBI. The primary fetal outcomes considered were babies born alive, stillbirth, Apgar score at 5 minutes and birth weight. The secondary maternal outcomes considered were the duration of stay in ICU, mechanical ventilation of the patient, duration of ventilation, use of inotropes and blood/blood products, and whether the patient had a tracheostomy, laparotomy/re-laparotomy, re-intubation or renal replacement therapy while in ICU, and the need for re-admission to ICU. The secondary fetal outcome considered was whether or not the delivery of the fetus was undertaken to facilitate maternal care.

Most obstetric patients are admitted to ICUs in the puerperium. To increase the sample size for meaningful results of fetal outcomes, we evaluated patients who were delivered of their babies: (*i*) within 24 hours before ICU admission, (*ii*) during their stay in ICU and (*iii*) within 24 hours after ICU discharge. This choice was based on the assumption that the outcome of delivery will be influenced predominantly at these periods by the same events that led to ICU admission.

Institutional ethical and hospital permission were obtained prior to study commencement. Informed consent was not obtained from individual patients. This was waived by the ethics committee because the study was observational and critically ill patients were adjudged to be too ill to give informed consent. Moreover, data were only obtained from the hospital charts and were kept confidential.

The GRAMPT model

This is a risk stratification or outcome prediction model devised for critically ill obstetric patients (gestational >20 weeks) and gynaecological patients (gestational age <20 weeks). The variables in the GRAMPT model are the **G**lasgow coma score (GCS), **R**espiratory rate (Resp), **A**ge in years, **M**ean arterial pressure (MAP), **p**H, and **T**emperature (°C). The GRAMPT model has three different formulae based on the gestational age and pathology (thus adjusting for the effect of the intrinsic potential of each disease on mortality). The applicable formula is used to calculate the GRAMPT score for each patient.

A calculated GRAMPT score above a threshold of 0.21 in hypertensive obstetric patients, 0.31 in non-hypertensive obstetric patients and 0.32 in gynaecological patients predicts ≥50% risk of maternal death.

The GRAMPT score, as initially devised by Paruk, was calculated using the patient's age and the worst values of each parameter (GCS, Resp, MAP, pH and temperature) during the first 24 hours following ICU admission.[5] In contrast, in our study, we intentionally used the GRAMPT score obtained at the time of the patients' admission to ICU. This was done in an effort to identify whether the GRAMPT score obtained at the time of ICU admission might assist with triage.

Statistical analysis

Data were analysed using SPSS 19 and results are presented as frequencies, percentages, median, mean and range. Where possible, risk was determined by relative risk (RR) regardless of the sample size. The areas under the receiver operating characteristic (ROC) curves (AUC) were calculated to assess the performance of the GRAMPT model in predicting mortality/HIBI. Statistical significance was assumed at $p<0.05$. The sample size was not calculated before the study commenced because the study duration was based on convenience due to time constraints.

Results

Of the 919 patients admitted to the ICUs during the study period, 82 (8.9%) were pregnant or post partum. Two pregnant patients who were admitted to the ICU in June 2010 were still in the ICU when data collection began in July 2010, and were included in the study, resulting in a sample size of 84. The proportion of patients admitted to the ICU was 51 (60.7%) in the regional hospitals and 33 (39.3%) in the tertiary hospitals. Overall, 66 (78.6%) postpartum patients and 18 (21.4%) antepartum patients constituted the study cohort.

The HIV sero-status was HIV-unknown in 11 (13.1%) patients, HIV-negative in 42 (50%) and HIV-positive in 31 (36.9%). The CD4 count was known in 22 (71%) of the HIV-positive women. Only 25% of those with a CD4 count ≤200 cells/μl were receiving co-trimoxazole prophylaxis. Of those who were HIV-positive, 8 (25.8%) were receiving ART while 10 (32.3%) were receiving zidovudine (AZT). Among the 19 HIV-positive patients whose gestational ages were known to be ≥14 weeks, 12 (63.3%) were receiving either ART or AZT prophylaxis.

The patients were aged 15 - 43 years (overall mean 25.1 years; SD ±7.17). The mean age of the HIV-unknown patients was 24.09 years (SD ±6.20), HIV-negative patients 22.29 years (SD ±6.37) and HIV-positive patients 29.19 years (SD ±7.17). Most (56.0%) were aged 20 - 34 years and this age group comprised the majority in both HIV-positive (64.5%) and HIV-negative (47.2%) patients.

The pre-ICU admission diagnosis and the indications for ICU admission are shown in Table 1. The ROC curve in Fig. 1. shows

the performance of the GRAMPT model in predicting mortality or HIBI. The primary maternal outcome is shown in Table 2. Death and HIBI were commoner in HIV-positive patients than in HIV-negative patients: 11 deaths and 1 HIBI (38.71%) v. 4 deaths and 2 HIBI (14.29%) The following patients with a high GRAMPT score died or had HIBI: 7 (63.6%) HIV-positive patients and 2 (33.3%). HIV-negative patients. The relative risk (RR) of death/HIBI among HIV-positive patients with a high GRAMPT score was 1.91 (CI 95% 0.57 - 6.44). The percentage who had a low GRAMPT score and survived were: 55 (83.3%) of the total patient population, 15 (75%) HIV-positive patients and 32 (88.9%) HIV-negative patients.

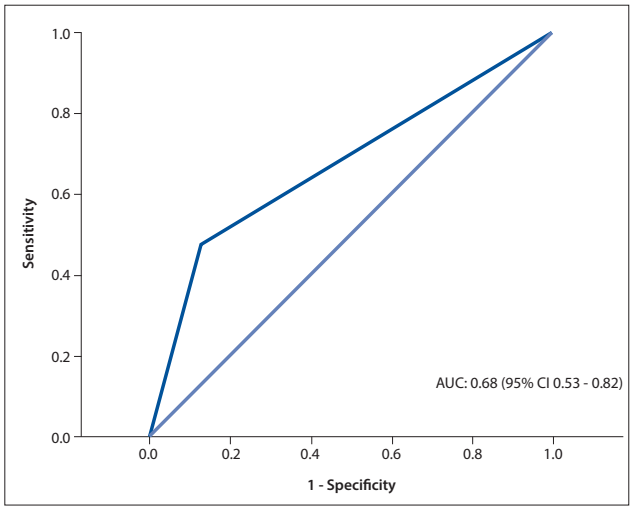

*Fig. 1. ROC curve (for all patients) showing the performance of GRAMPT in predicting death or hypoxic ischaemic brain injury. *The area under the curve (AUC) for patients in each GRAMPT subcategory was 0.57 (95% CI 0.23 - 0.91), 0.72 (CI 0.48 - 0.96) and 0.68 (CI 0.47 - 0.90) for gynaecological, hypertensive obstetric and non-hypertensive obstetric patients, respectively.*

Eight patients underwent cardiopulmonary resuscitation before ICU admission. Following their admission to ICU, 2 (25%) survived, 3 (37.5%) died and 3 (37.5%) had HIBI. The pre-ICU diagnoses of the 18 patients who died were pneumonia (3), eclampsia (3), placental abruption (2), isolated renal failure (2), valvular heart disease (1) and gunshot (1). Of the 22 (71%) HIV-positive women with a known CD4 count, 2 (50%) of the 4 patients with a CD4 count of ≤200 cells/μl died or had HIBI; but among the 18 women with a CD4 count >200 cells/μl, 6 (33.33%) died or had HIBI.

All individual secondary maternal outcomes (Table 3) and fetal outcomes (Table 4) were worse among HIV-positive than HIV-negative patients but differences were not statistically significant.

Discussion

Pregnant and postpartum patients constituted 8.9% of all admissions to the adult ICUs in our study. This figure is less than the 13.6% reported in a similar study done in Durban, SA,[9] which preceded the widespread use of effective ART. Nevertheless, our figure is within the range of 0.4 - 16% reported by Pollock *et al.,* in their systematic review on pregnant and postpartum admissions to the ICUs.[10] The majority (78.6%) of our patients were in their postpartum period.

Table 1. The main pre-ICU admission diagnosis and the main indication for ICU admission

	HIV status, *n* (%)			
Diagnosis/indication	**HIV unknown (*N*=11)**	**HIV-negative (*N*=42)**	**HIV-positive (*N*=31)**	**Total (*N*=84)**
Pre-ICU admission diagnosis				
Eclampsia	3 (27.27)	13 (30.95)	3 (9.68)	19 (22.62)
Severe pre-eclampsia	1 (9.09)	6 (14.29)	1 (3.23)	8 (9.52)
Pneumonia	0 (0)	0 (0)	6 (19.35)	6 (7.14)
Placental abruption	0 (0)	4 (9.52)	3 (9.68)	7 (8.33)
Puerperal sepsis	1 (9.09)	1 (2.38)	3 (9.68)	5 (5.95)
C/section for breech, FC & CPD	0 (0)	3 (7.14)	1(3.23)	4 (4.76)
Placenta praevia	0 (0)	3 (7.14)	1 (3.23)	4 (4.76)
Abortion	1 (9.09)	1 (2.38)	2 (6.45)	4 (4.76)
Valvular heart disease	0 (0)	2 (4.76)	1 (3.23)	3 (3.57)
Others	5 (45.45)	9 (21.43)	10 (32.26)	24 (28.57)
Indication for ICU admission				
Obstetric haemorrhage	2 (18.18)	12 (28.57)	8 (25.81)	22 (26.19)
Sepsis	3 (27.27)	1 (2.38)	6 (19.35)	10 (11.90)
Respiratory failure	0 (0)	1 (2.38)	8 (25.81)	9 (10.71)
Repeated fits	1 (9.09)	4 (9.52)	2 (6.45)	7 (8.33)
Monitoring	1 (9.09)	1 (2.38)	4 (12.90)	6 (7.14)
Pulmonary oedema	0 (0)	4 (9.52)	1 (3.23)	5 (5.95)
Low Glasgow coma scale	2 (18.18)	2 (4.76)	0 (0)	4 (4.76)
Cardiac arrest	0 (0)	4 (9.52)	0 (0)	4 (4.76)
Others	2 (18.18)	13 (30.95)	13 (41.94)	17 (20.24)

C/section = caesarean section; FC = fetal compromise; CPD = cephalopelvic disproportion.

Table 2. Primary maternal outcome (*N*=84)

HIV status	GRAMPT score*	Outcome, *n* (%)			
		Survived	HIBI	Died†	Total
Unknown	Low	8	0	2	10
	High	0	0	1	1
	Total	8	0	3	11
Negative	Low	32	1	3	36
	High	4	1	1	6 (14.29)
	Total	36	2	4	42
Positive	Low	15	0	5	20
	High	4	1	6	11 (35.42)
	Total	19	1	11	31
Total	Low	55 (87.30)	1 (33.33)	10 (55.56)	66 (78.57)
	High	8 (12.70)	2 (66.67)	8 (44.44)	18 (21.43)
	Total	63	3	18	84

HIBI = hypoxic-ischaemic brain injury.
* The number of patients in each of the GRAMPT subcategories were 15 (17.9%) gynaecological, 31 (37.0%) hypertensive obstetric and 38 (45.3%) non-hypertensive obstetric patients. Each patient had only one of the following: survived, died or HIBI.
† The term 'maternal death' as used in this study refers to mothers who died during the study, and includes one death from gunshot, recognising that death from gunshot does not meet the ICD 10 definition of maternal death.

Recent studies report that high proportions (between 76.7%[11] and 95.3%[12]) of postpartum patients are admitted to ICUs. In contrast, a tertiary centre in Saudi Arabia reports that 78.6% of patients were admitted to ICUs in the antenatal period.[13] These conflicting reports may be due to different indications for ICU admission in different centres. It is likely, however, that the initiating adverse events occur in the antenatal period. The 2008 - 2010, Saving Mothers' Report indicates that a considerable number of women in SA die in the postpartum period, following an antenatal adverse event.[8]

In our study, 36.7% of HIV-positive patients whose pregnancies were ≥14 weeks were not receiving ART, despite published SA national clinical guidelines recommending that all HIV-positive pregnant patients with a CD4 count >350 cells/μl should be initiated on AZT from 14 weeks' gestation to prevent mother-to-child transmission, while those with a CD4 count ≤350 cells/μl should be initiated on ART irrespective of their gestational age. Our study also showed that only 25% of HIV-positive patients with a CD4 count ≤200 cells/μl were receiving co-trimoxazole. These factors may be contributing to the high incidence of pneumonia among HIV-positive patients.

The most common overall pre-ICU admission diagnosis among pregnant patients admitted to our ICUs was pre-eclampsia/eclampsia syndrome (32.1%). This is similar to the findings of other studies.[10,13] However, among HIV-positive patients, pneumonia was the commonest pre-ICU admission diagnosis, probably because HIV is associated with pulmonary infections due to immune supression. Pre-eclampsia/eclampsia syndrome was commoner among our HIV-negative than HIV-positive patients. This may be because HIV-positive patients are less likely to mount a sufficient immunological response to develop pre-eclampsia/eclampsia, especially if they are not receiving ART.[14]

A review of the literature[15] supports our findings that respiratory failure is the most common indication for admitting HIV-positive patients to ICUs. Major obstetric haemorrhage however, was the commonest indication for ICU admission among our HIV-negative patients; this possibly reflects the high prevalence of placental abruption and abdominal delivery.

The ROC showed that the GRAMPT model as a predictor of death or HIBI performed best among hypertensive obstetric patients (ROC: AUC 0.72; 95% CI 0.48 - 0.96). This scoring system can be valuable as a predictor of mortality/survival at the time of admitting a pregnant or post partum patient to ICU. However, it should be noted that, for practical reasons, our usage of the GRAMPT score was based also on parameters available at the time of admission, and not solely on abnormal parameters measured over the first 24 hours, as in the original definition of GRAMPT by Paruk. It is possible that the use of the original method of GRAMPT scoring would have improved this model's predictive value. Given GRAMPT's performance in this study, we suggest that this model may be used to assist with patient triage (especially of hypertensive obstetric patients) for ICU admission by providing important additional information. The caveat, however, is that the inconsistency of mathematical models in predicting ICU survival among pregnant women admitted to different ICUs[4] demands that the performance of GRAMPT needs to be validated at individual centres prior to its use.

Of the 18 maternal deaths, 15 occurred in the ICUs while 3 occurred in the ward within 7 days of ICU discharge (a ratio of 5:1). This is because some clinical conditions can worsen soon after ICU discharge. Maternal deaths among obstetric patients in ICUs is as low as zero in some centres in Australia, Canada and Saudi Arabia[10] and as high as 43.6% in India.[16] Although the profile of obstetric patients admitted to ICUs in well-resourced and under- resourced countries is similar,[10] the difference in percentage of maternal deaths may be related to differences in obstetric services. In our study, the increased rate of death among HIV-positive patients is probably related to infectious morbidity noted among this group of patients, since not all were on ART. In the USA, the use of any ART among HIV-positive patients admitted to ICU showed a tendency towards decreased mortality, but this did not reach statistical significance (OR 0.53; 95% CI 0.22 - 1.33).[17]

The differences in the utilisation of ICU facilities observed in different centres are largely related to the patients' profile that includes severity of illness and response to treatment. In this study for instance, the length of ICU stay varied from 10 hours to 37.0 days with a median of 2.0±36.6 days. However, a systematic review by Pollock *et al.*[10] reflected a mean ICU stay of 1.0 - 8.8 days.The use of mechanical

Table 3. Secondary maternal outcomes

Secondary outcome	HIV-unknown	HIV-negative	HIV-positive	Total	RR in HIV-positive patients (95% CI)	*p*-value
Days of stay in ICU, median±SD*	36.60±2.08	1.83±25.98	2.04±20.69	2.0±36.60		
Patients, *n*	11	42	31	84		
(range: 10 hours - 37.02 days)						
Days of MV, median±SD	0.63±32.52	0.88±26.23	2.04±20.94	1.27±32.50		
Patients, *n*	*n*=9†	*n*=33	*n*=25	*n*=67		
(range: 30 minutes - 32.50 days)						
Use of MV (%)						0.83
No	1 (9.09)	9 (21.43)	6 (19.35)	16 (19.05)	1.03 (0.81 - 1.30)	
Yes	10 (90.91)	33 (78.57)	25 (80.65)	68 (80.95)		
Use of inotropes, *n* (%)						0.17
No	7 (63.64)	27 (64.29)	15 (48.39)	49 (58.33)	1.45 (0.85 - 2.46)	
Yes	4 (36.36)	15 (35.71)	16 (51.61)	35 (41.67)		
Use of blood products, *n* (%)						0.54
No	3 (27.27)	22 (52.38)	14 (45.16)	39 (46.43)	1.15 (0.73 - 1.81)	
Yes	8 (72.72)	20 (47.620)	17 (54.84)	45 (53.57)		
Use of tracheostomy, *n* (%)						0.65
No	9 (81.82)	38 (90.48)	27 (87.10)	74 (88.10)	1.35 (0.37 - 5.00)	
Yes	2 (18.18)	4 (9.52)	4 (12.90)	10 (11.90)		
Use of laparotomy/re-laparotomy, *n* (%)						0.24
No	6 (54.55)	38 (90.48)	25 (80.65)	69 (82.14)	2.03 (0.63 - 6.59)	
Yes	5 (45.45)	4 (9.52)	6 (19.35)	15 (17.86)		
Use of re-intubation (except for medical procedure), *n* (%)						0.12
No	10 (90.91)	41 (97.62)	27 (87.10)	78 (92.86)	5.42 (0.64 - 46.14)	
Yes	1 (9.09)	1 (2.38)	4 (12.90)	6 (7.14)		
Re-admission to ICU, *n* (%)						0.83
No	10 (90.91)	41 (97.62)	30 (96.77)	81 (96.43)	1.36 (0.09 - 20.83)	
Yes	1 (9.09)	1 (2.38)	1 (3.23)	3 (3.57)		
Renal replacement therapy, *n* (%)						0.24
No	11 (100)	39 (92.86)	26 (83.87)	76 (90.48)	2.26 (0.58 - 8.75)	
Yes	0 (0)	3 (7.14)	5 (16.13)	8 (9.52)		

SD = standard deviation; RR = relative risk; MV = mechanical ventilation.
*Duration of stay in ICU is the time interval between the patient's arrival in the ICU for admission and her departure after discharge.
†Patient number 14 (with an unknown HIV status and low GRAMPT score) had MV but was excluded from the calculation of median days of MV because her duration of ventilation could not be established.

ventilation was very high (81.0%) among our patients compared with 58% reported in a regional hospital in Hong Kong.[18] Nonetheless, our findings are comparable with the 85% reported in Turkey.[19] In this study the use of tracheostomy and dialysis was 4% and 5%, respectively, compared with 11.9% and 9.52% respectively in our study.

Overall, the individual secondary maternal outcomes measures were worse among HIV-positive patients although this disparity did not reach statistical significance. These differences in these secondary maternal outcomes may reflect that 35.4% of HIV-positive and 14.3% of HIV-negative patients had high GRAMPT scores (a marker of disease severity). Not surprisingly, HIV-positive women had a longer duration of stay in ICU. Also, the severity of illness could account for a higher percentage of re-admission among HIV-positive patients. The use of mechanical ventilation, duration of mechanical ventilation and re-intubation were more common among HIV-positive patients among whom respiratory failure was more prevalent. Their longer duration of ventilation may also account for the increased use of tracheostomy. The use of inotropic agents, and laparotomy/re-laparotomy were more common in HIV-positive patients as a result of sepsis in this group. The differences in the use of blood products and renal replacement therapy are difficult to explain.

Apgar scores of 1 - 6 were more common in infants of HIV-negative than HIV-positive patients. We think that this may be due to the increased use of sedation prior to delivery in obstetric hypertensive patients. Stillbirth and low birth weight while worse among HIV-positive than -negative patients, were not statistically different (p=0.09 and 0.14, respectively). Generally, each of the fetal outcomes is difficult to explain by any single reason.

Table 4. Fetal outcomes

Outcomes for babies >500 g*	HIV unknown (*N*=3) *n* (%)	HIV-negative (*N*=29) *n* (%)	HIV-positive (*N*=13) *n* (%)	Total (*N*=45) *n* (%)	RR in HIV-positive patients (95% CI)	*p*-value
APGAR score in 5 minutes						
Stillborn	1 (33.33)	10 (34.48)	8 (61.54)	19 (42.22)	1.78 (0.79 - 3.45)	0.09
1 - 6	1 (33.33)	6 (20.69)	1 (7.69)	8 (17.78)	0.37 (0.05 - 2.78)	0.33
7 - 10	1 (33.33)	13 (44.83)	4 (30.77)	18 (40.00)		
Birth weight (g)						
>500 - <2 500	2 (66.67)	16 (55.17)	10 (76.92)	28 (62.22)	1.39 (0.90 - 2.17)	0.14
>2 500 - 4 000	1 (33.33)	13 (44.83)	3 (23.08)	17 (37.78)		
Emergency abdominal delivery to facilitate maternal care						
No	3 (100)	28 (96.55)	11 (84.62)	42 (93.33)	4.46 (0.44 - 44.93)	0.20
Yes	0 (0)	1 (3.45)	2 (15.38)	3 (6.67)		

* These data were for patients who were delivered of their babies: (*i*) within 24 hours before ICU admission (42; 93.3%); (*ii*) while on admission in ICU (3; 6.7%); and (*iii*) within 24 hours after ICU discharge (0; 0%).

There are limitations to this study. Most importantly, sample size calculation was not done prior to data collection. The wide confidence limits in the RR may be ascribed to the relatively small size of our study. Other limitations were: (*i*) the use of blood products and inotropes outside the ICU setting was not evaluated. Usage of these agents prior to ICU admission may reduce their usage in the ICUs; (*ii*) the HIV sero-status was unknown in 11 (13.1%) patients; (*iii*) due to sparse distribution of data within tables, not all the outcome measures were presented under low and high GRAMPT sub-categories or under specific diagnosis; (*iv*) the performance of GRAMPT as an outcome predictor could have been underestimated because the GRAMPT scores obtained at the time of patients' admission to the ICUs were used, rather than the worst scores in the first 24 hours following ICU admission; (*v*) due to the fact that many patients came from rural areas with poor telecommunication and transport services, it was not possible to achieve follow-up to the extent required to determine 28-day all-cause mortality. Despite these shortcomings, to our knowledge, our study is the first to risk stratify pregnant patients utilising the GRAMPT score obtained at the time of patients' admission to ICU.

Conclusion

All maternal and fetal outcomes, except for infant Apgar scores of 1 - 6, showed a worse trend among HIV-positive than HIV-negative patients. These findings may hinder admission of HIV-positive pregnant patients to ICUs in favour of HIV-negative patients, who may be adjudged to have better outcomes. Larger studies are therefore urgently needed to investigate these trends more completely. Until such studies are done, we believe that HIV sero-status should not be used as an isolated determinant of admission to ICUs.

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References

1. Hazelgrove JF, Price C, Pappachan VJ, Smith GB. Multicenter study of obstetric admissions to 14 intensive care units in southern England. Crit Care Med 2001;29(4):770-775. [http://dx.doi.org/10.1097/00003246-200104000-00016]
2. Abubakar AS, Ojo EO, El-Nafaty AU, Edomwonyi NP. An audit of one-year intensive care practice in a developing country. The Internet Journal of Anesthesiology 2008;18(2). http://www.ispub.com/journal/the-internet-journal-of-anesthesiology/volume-18-number-2/an-audit-of-one-year-intensive-care-practice-in-a-developing-country.html (accessed 17 November 2012).
3. Bhagwanjee S, Muckart DJJ, Jeena PM, Moodley P. Does HIV status influence the outcome of patients admitted to a surgical intensive care unit? A prospective double blind study. BMJ 1997;314(7087):1077-1081. [http://dx.doi.org/10.1136/bmj.314.7087.1077a]
4. Gopalan PD, Muckart DJJ. The critically ill obstetric patient: What's the score? Int J Obstet Anesth 2004;13(3):144-145. [http://dx.doi.org/10.1016/j.ijoa.2004.04.005]
5. Paruk F. Critically ill obstetric and gynaecology patients: The development and validation of an outcome prediction model. MD thesis. Durban: University of KwaZulu-Natal, 2007;1-148.
6. UNAIDS. Report on the Global AIDS Epidemic 2012. http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2012/gr2012/20121120_UNAIDS_Global_Report_2012_with_annexes_en.pdf (accessed 8 March 2013).
7. South African National Department of Health. The 2010 National Antenatal sentinel HIV and Syphilis Prevalence Survey in South Africa. http://us-cdn.creamermedia.co.za/assets/articles/attachments/36647_hiv_aids_survey.pdf. (accessed 17 November 2012).
8. NCCEMD. Saving Mothers 2008-2010: Fifth Report on the Confidential enquiries into Maternal Deaths in South Africa – Short Report. http://www.doh.gov.za/docs/reports/2012/savingmothersshort.pdf (accessed 17 November 2012).
9. Platteau P, Engelhardt T, Moodley J, Muckart DJ. Obstetric and gynaecological patients in an intensive care unit: A 1 year review. Trop Doct 1997;27(4):202-206.
10. Pollock W, Rose L, Dennis CL. Pregnant and post partum admissions to the intensive care unit: A systematic review. Intensive Care Med 2010;36(9):1465-1474. [http://dx.doi.org/10.1007/s00134-010-1951-0]
11. Crozier T, Wallace EM. Obstetric admissions to an integrated general intensive care unit in a quaternary maternity facility. Aust N Z J Obstet Gynaecol 2011;51(3):233-238. [http://dx.doi.org/10.1111/j.1479-828X.2011.01303.x]
12. Lataifeh I, Amarin Z, Zayed F, Al-Mehaisen L, Alchalabi H, Khader Y. Indications and outcome for obstetric patients' admission to intensive care unit: A 7-year review. J Obstet gynaecol 2010;30(4):378-382. [http://dx.doi.org/10.3109/01443611003646298]
13. Aldawood A. Clinical characteristics and outcomes of critically ill obstetric patients: A ten-year review. Ann Saudi Med 2011;31(5):518-522. [http://dx.doi.org/10.4103/0256-4947.84631]
14. Wimalasundera RC, Larbalestier N, Smith JH, et al. Pre-eclampsia,antiretroviral therapy, and immune reconstitution. Lancet 2002;360(9340):1152-1154.
15. Huang L, Quartin A, Jones D, Havlir DV. Intensive care of patients with HIV infection. N Engl J Med 2006;355(2):173-181. [http://dx.doi.org/10.1056/NEJMra050836]
16. Irene YV, Vaneet K, Gurvinder K, Arun A, Lalita A. Critical care in obstetrics – scenario in a developing country. J Obstet Gynecol India 2008;58(3):217-220. http://medind.nic.in/jaq/t08/i3/jaqt08i3p217.pdf (accessed 18 November 2012).
17. Greenberg JA, Lennox JL, Martin GS. Outcomes for critically ill patients with HIV and severe sepsis in the era of highly active antiretroviral therapy. J Crit Care 2012;27(1):51-57. [http://dx.doi.org/10.1016/j.jcrc.2011.08.015]
18. Leung NY. Clinical characteristics and outcomes of obstetric patients admitted to the Intensive Care Unit: A 10-year retrospective review. Hong Kong Med J 2010;16(1):18-25.
19. Togal T, Yucel N, Gedik E, et al. Obstetric admissions to the intensive care unit in a tertiary referral hospital. J Crit Care 2010;25(4):628-633. [http://dx.doi.org/10.1016/j.jcrc.2010.02.015]

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